Studies of an Island Population of *Rattus fuscipes*

by

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Very little is yet known about the ecology of the small mammals on the islands of Bass Strait. Some islands maintain only a population of rabbits while others support native species. Two species of small mammals inhabit Greater Glennie Island; the murid rodent *Rattus fuscipes* and the dasyurid *Antechinus minimus maritimus*.

In December 1967, the Monash University Biological Society began a study of *R. fuscipes* which had four basic aims:—

1. To compare the morphological characteristics with those of two mainland populations of *R. fuscipes*.
2. To establish the density of the population and to compare it with that normally occurring on the mainland.
3. To determine the effect of the high population density on home range.
4. To establish the age structure of the population with a view to finding out when the breeding season was.

Vegetation

The majority of the trapping area was covered in low scrub, varying from two to six feet in height and forming a dense canopy. The ground cover in this area was not very dense but was composed of decaying plant material. This was quite dry in the summer. Interspersed among the scrub were patches of tussock grass.

The south-western section of the trapping area was at a higher elevation. The vegetation there was *Casuarina*. In this section the ground cover was also light. Toward the lower section in the north-west of the trapping area, were exposed rocky patches with a mixed cover of tussock grass, low scrub and some pig-face succulent.

The western section was exposed to strong winds carrying salt spray. However, only the extreme western trapping stations could be affected by this as the scrub formed such a dense canopy.

Methods

The trapping area for estimation of population density and home range was 3.6 acres (14,600 square metres). Eighty trapping stations were marked out, in ten rows of eight, each station being fifty feet distant from its nearest neighbour.

The traps used were similar to National collapsible cage traps. Twenty traps were used each trapping night and were distributed over the grid in three different ways:—

1. The traps were evenly distributed, each being two stations distant from the next. Every night, they were rotated so that after four successive nights, all stations had been trapped.
2. One quarter of the grid was trapped in a block. The traps were shifted as a block so that all stations had been trapped in four nights.
3. Random numbers were chosen each night.

Rats were transferred from the trap to a polythene bag in which they were anaesthetised with ether. While in the bag, they were weighed. They were then ear-tagged with Monel fingerling tags. After recovery, they were released.

Twenty-one rats, trapped away from the grid, were killed in order to obtain skins and skulls. Body measurements of these were also made. Twenty skulls collected at Noojee in Gippsland, by Mr. R. M. Warneke of the Fisheries and Wildlife Department, were measured and compared with the measurements of the skulls of the island population. Another ten skulls loaned by the National Museum of Victoria, collected at Portland, Western Victoria, were also measured and compared with the Glennie population.

Two live rats, one of each sex, were removed from the island to be used in breeding experiments, but in fact they never bred in captivity, for reasons unknown.

Results

1. *Density estimates*

The trapping programme was designed for estimation of home range and population density. Trap success was calculated by dividing the total number of rats caught by the number of traps set and expressing this as a percentage. Any trap which was found empty, with the bait removed, was not counted as a set trap. Any trap found sprung, with the bait still inside was counted as half a set trap, because it would probably have been open, on the average, for half a night. Traps containing other species were not counted as set traps.

Thus:

$$\text{Trap success} = \frac{100N}{T - [a + b + (c/2)]}$$

N = total individuals caught.
T = total traps set.
a = traps found without bait.
b = traps with other species.
c = empty traps, sprung, with bait inside.

By this method, the overall trap success for the 1967-1968 period was 101%. In some cases, two rats were found in a trap. The trap success was so high in each period that it could not be used as a method of determining population density changes.

The population density was calculated by a method outlined in Eberhardt (1969). The formula used is given below.

$$N = \frac{r(s-1)}{s-r}$$, where N=population size
s=total captures.
r=total individuals caught.

The first estimate (See Table 1) was made using data collected over only three nights. This resulted in an inaccurate estimation because (s–r) is small. Consequently, a small error in (s–r) results in a large error in N. The estimates for later periods are probably more reliable.

Table 1.
Population density.

Date	Number captured			Estimated population size	Individuals per acre
	M	F	Juv.		
December 1967	20	18	1	216	60
January 1968	39	48	14	92	25
February 1968 (early)	18	45	28	97	27
February 1968 (late)	32	25	67	121	33
December 1968	31	28	6	92	25

2. *Home range*

Home range is here defined as the area encompassed by the trap sites of capture. Each trap site, as the basis of tabulating home range, was a square of sides 50 feet, or an area of 2,500 square feet. Home range was estimated by multiplying this area by the number of trap sites within the area of capture. Only those rats which were trapped nine or more times were used in this estimation. The results are shown in Table 2.

TABLE 2.
Home range.

Tag number	Sex	Number capts.	Number sites	Home range (sq. yds.)
806	F	11	3	844
812	F	13	8	4,170
813	F	15	11	6,110
817	F	9	7	2,780
825	F	12	9	4,170
838	M	11	5	3,060
844	M	11	5	1,390

3. *Comparisons of morphological features.*

(a) Sex differences.

Body measurements of males of the island population were compared to those of females by means of a "Student's t-test". As is shown in Table 3, a difference was found only in body weight. Skull measurements were compared in the same manner. There were no significant differences between sexes for all skull measurements taken.

TABLE 3.
Body measurements of island population.

	Mean		Result
	Female	Male	
Weight (gms.)	189.6	213.4	Difference at 5% level of significance
Head-body length (mm.)	174.4	178.0	No significant difference.
Tail length (mm.)	181.2	186.9	,, ,, ,,
Hind-foot length (mm.)	37.9	37.4	,, ,, ,,
Ear length (mm.)	24.1	23.4	,, ,, ,,

(b) Comparison of skull measurements between Glennie, Gippsland and Portland populations.

The results of a statistical comparison of skull measurements are shown in Table 4. Skull measurements used are shown in the diagram. Since the Glennie population has larger skulls than the other two populations, a similar comparison of some ratios of skull measurements was made. This is summarised in Table 5.

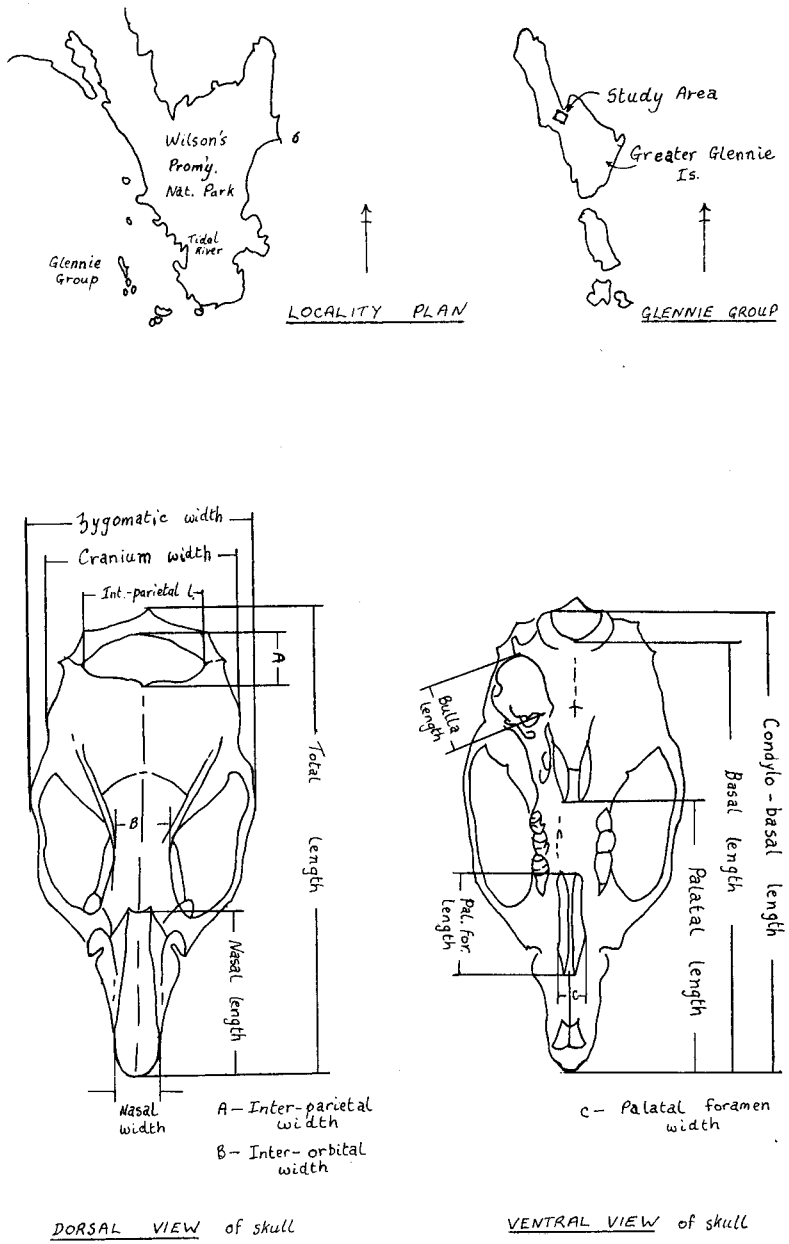

Fig. 1

TABLE 4.

Skull measurements.

	Lengths of Glennie population in mm. Range	Mean	Comparison with level of significance. Gippsland population	Portland population
1. Total length	40.0 - 44.9	42.24	larger 1%	larger 1%
2. Condylo-basal length	38.7 - 43.2	40.74	„ 1%	„ 1%
3. Basal length	36.4 - 41.1	38.39	„ 1%	„ 1%
4. Zygomatic width	20.7 - 23.2	21.78	„ 1%	„ 1%
5. Inter-orbital width	6.2 - 6.9	6.49	„ 1%	„ 1%
6. Inter-parietal length	10.8 - 12.3	11.66	„ 1%	„ 1%
7. Inter-parietal width	4.7 - 5.9	5.34	„ 1%	„ 1%
8. Cranium width	16.1 - 17.5	16.73	„ 1%	„ 1%
9. Nasal length	16.3 - 18.8	17.43	„ 1%	„ 1%
10. Nasal width	4.6 - 5.2	4.94	„ 1%	„ 1%
11. Palatal length	21.7 - 24.0	22.73	„ 1%	„ 1%
12. Palatal foramen length	7.2 - 8.2	7.76	no sig. dif.	„ 1%
13. Palatal foramen width	2.7 - 3.4	3.02	larger 1%	„ 1%
14. Width inside M1-M1	4.0 - 4.9	4.36	„ 1%	„ 1%
15. Width outside M1-M1	8.3 - 9.7	8.83	„ 1%	„ 1%
16. Bulla length	6.3 - 7.0	6.67	no signif. difference	no signif. difference
17. Length of crowns M1-M3	6.7 - 7.3	6.92	larger 1%	larger 1%
18. Length of alveoli M1-M3	7.7 - 8.9	8.29	„ 1%	„ 1%
19. Length of crowns M1-M2	5.2 - 6.0	5.60	„ 1%	„ 1%
20. Incisor width (each)	1.4 - 1.6	1.46	„ 1%	„ 1%

TABLE 5.

Ratios of skull measurements.

Ratio	Means			Result	
	Glennie	Gipps	Portld.	Gl-Gi	Gl-Por
1. Zyg. wid./tot. leng.	0.516	0.510	0.511	NSD*	NSD
2. Inter-pariet, leng./tot. leng.	0.267	0.251	0.273	1%	NSD
3. Cranium wid./tot. leng.	0.396	0.402	0.420	NSD	1%
4. Nas. leng./tot. leng.	0.412	0.368	0.381	1%	1%
5. Palatal leng./tot. leng.	0.538	0.543	0.524	NSD	1%
6. Inter-par. leng./Inter-par. wid.	2.191	2.192	2.284	NSD	NSD
7. Nas. leng./nas. wid.	3.522	3.364	3.308	1%	1%
8. Pal. foram. leng./pal. foram wid.	2.572	3.417	2.725	1%	NSD

*no significant difference.

The results tend to show that the two mainland populations are more similar to each other than to the Glennie population. Also, the Glennie population does not appear to have more affinities with one mainland population than the other.

4. *Breeding season*

Only one juvenile animal was trapped in December 1967. (See Table 1.) Many were trapped in January 1968, but only one new juvenile was trapped in late February. Mating must therefore take place from November to late December, allowing a gestation period of 21 days and a weaning period of four weeks. A more detailed study of the reproductive condition of the rats by Mr. R. M. Warneke during the period 27 September to 3 October 1968 indicated that the breeding season was about to begin.

Four animals which were mature in January 1968 were still alive in December 1968. It is not known if any animals live any longer than two years.

CONCLUSIONS AND DISCUSSION

There has recently been a revision of *Rattus* species in Australia, based on cross breeding experiments. Horner and Taylor, 1965). The population of rats in Portland was once regarded as a separate species from the Gippsland population, the former being called *R. greyi,* and the latter *R. assimilis.* These two species, and a Western Australian species called *R. fuscipes* have now been grouped together as the one species *R. fuscipes.* It is almost certain that the population on Greater Glennie Island can be ascribed to the species *R. fuscipes,* in spite of the morphological differences here described. It would be unrealistic at this stage to call the Glennie rat a new subspecies. As was seen in Tables 4 and 5, there are not many morphological differences between the Glennie, Gippsland and Portland populations. The most striking difference is the large overall size of the Glennie population. This is of interest as it seems to be a common feature of island races of small mammals to be of large size. (Corbet, 1963). The Glennie population also has relatively longer nasal bones, but few other significant differences exist.

The density of the population is very much higher than is normally found on the mainland. One source (Warneke, unpublished) quotes a figure of 4.8 individuals per acre. The high density on Glennie may be due to all or any of a number of factors. There is a general lack of predators on the island. Natural predators on the mainland, but absent on Glennie, include snakes and many species of predatory birds. There are some predatory birds from the mainland feeding on Glennie, but very few inhabit the island, due to a shortage of suitable nesting sites. Other predators absent on Glennie are feral cats, and foxes. The introduction of these to the mainland may have had considerable effect on the small mammal fauna of Australia.

Greater Glennie Island does not support a rabbit population. Although it is not suggested that direct competition takes place, rabbits have seriously affected the natural habitat on other Bass Strait islands.

It appears, from the little information on home range obtained, that there is no appreciable difference from that occurring in less dense populations.

The skulls and skins which were collected from the island in December 1967, have been deposited in the museum of the Department of Zoology and Comparative Physiology, Monash University, Melbourne.

Summary

The density of the population of *R. fuscipes* on Greater Glennie Island is approximately 30 rats/acre, which is unusually high compared with populations elsewhere. Size of home range does not seem to be affected by this.

By comparing skull measurements with those of two separate populations on the mainland, it was found that the Glennie population is very probably *R. fuscipes*. Tables of skull and body measurements of the island population are given.

The breeding season is early summer; and individuals were observed to live for two years.

Acknowledgements

The author wishes to thank Dr. D. F. Dorward of the Department of Zoology and Comparative Physiology, Monash University, for his encouragement, assistance, and helpful criticism. Thanks are also due to the many members of the Monash University Biological Society, who collected the field data, and to Mr. R. M. Warneke of the Fisheries and Wildlife Department, Victoria for most of the mainland skulls, and for his reporting of some of our marked animals trapped.

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GEOLOGY GROUP EXCURSIONS

Sunday, 14 March—Deep Creek Gorge, Bulla. Leader: Mr. George Carlos.

Transport is by private car. Spare seats are usually available for those without their own transport. Excursions leave from the western end of Flinders Street Station, opposite the C.T.A. Building, at 9.30 a.m.

A TRIBUTE TO NOEL F. LEARMONTH

The death of Noel F. Learmonth, which occurred at Portland on 9 September, 1970 at the age of 90, has left a very big gap in the ranks of Field Naturalists, Conservationists and Historians.

In those 90 years Noel established legions of friends and admirers, and he amassed a knowledge of the history and natural history of the south-west of Victoria, which is unsurpassed.

Noel Fulford Learmonth was born at Ettrick, near Portland, in the far south-west of Victoria. His family arrived shortly after the Hentys, and his grandfather was the first Mayor of Portland. Noel attended Geelong Grammar School from 1895 to 1898, and maintained his connection with his old school right to the last.

On leaving school his first work was with a Government survey team sent out to survey the last connecting rail link with Mildura. Noel was the last surviving member of this team. Their experiences in this useless and almost desert country, as it was considered then, are well told in his latest book *Four Towns and a Survey.*

Next he was private secretary to the Minister for Lands, M. K. McKenzie, and about 1905 selected land in Queensland. After a number of years he left this property, because of the prickly pear menace, and returned to Tyrandarra where he and his wife made their home at "Carramar". In 1951 they retired to live in Portland.

Noel Learmonth wrote extensively. For many years he was a contributor to "The Bulletin", writing under the name of "Leo". He contributed nature notes to the "Portland Guardian" and several natural history journals. In the last two or three years he wrote many articles and letters on the Little Desert and Kentbruck controversy. His dry humour and ability to assemble words enabled him to strike at the very core of problems in a most telling manner.

In 1934 he wrote *The Portland Bay Settlement* (now out of print); in 1960 *The Story of a Port* (also out of print); and in 1967 *The Birds of Portland* (almost sold out). He donated this book to the Portland Field Naturalists Club. His last book *Four Towns and a Survey* has just been released. Unfortunately Noel did not see it.

Noel was interested in most sport, with cricket as his favourite. As a member of the Melbourne Cricket Club he always attended Test matches on that ground.

Outside his home and grazing interests his greatest love was the bush. From earliest days he seemed to have a strong leaning towards birds. He has made many valuable contributions to the ornithology of this far south west of the State. His recordings of sea birds, particularly beach washed specimens, sometimes in collaboration with Cliff Beaglehole, deserve particular mention. A number of rare finds have been recorded, the last one being the Broad-billed Prion (*P. vittata*), recorded in Bird Observer Notes in August 1970.